Computer Engineering Department

Faculty of Engineering, Mahidol University

LAB03: Image Enhancement in the Spatial Domain (part1)

Objectives

Upon completion of this lab, you will be able to:

1. Understand the concepts of image enhancement in spatial domain.
2. Describe the different types of gray-level transformations.
3. Write a user-defined function in MATLAB for the gray-level transformations, including image negatives, power-law transformations, bit plane slicing, histogram, and histogram quantization.

Introduction

Image enhancement is the process that improves the quality of a digital image for a specific application.

Image enhancement can be divided into two domains: spatial domain and transform domain. The methods in spatial domain refer to the two-dimension image plane and the approaches manipulating the pixel of given image. In transform domain, this method manipulates the Fourier transform of the given image.

In spatial domain, there are two types of image enhancement methods: gray-level transformation and Spatial filtering. Gray-level transformation (Point processing) uses the transformation function to all pixels in the given image, without the values of their neighbors. Spatial filtering (Neighborhood processing) consists of determining the output pixel value at the same position in the input value and the value of its neighbors, using a convolution operation.

Exercises

Note that you should create your own function in MATLAB as MATLAB User-defined function. It means that you cannot call MATLAB built-in function, which generates output in the same manner as your own function. You can use the images provided in the folder **\Google Drive\EGCI486-Image Processing\Second(2015-2016)\LABs\LAB03_Part1** for your exercises.

1) Image enhancement in spatial domain using image negatives

1.1 Write a user-defined function in MATLAB for converting the original image to obtain the negative image, with the following function name: Myneg.m. Using this program on the image "breast_digital_Xray.tif" should give you result as shown in Figure 1.

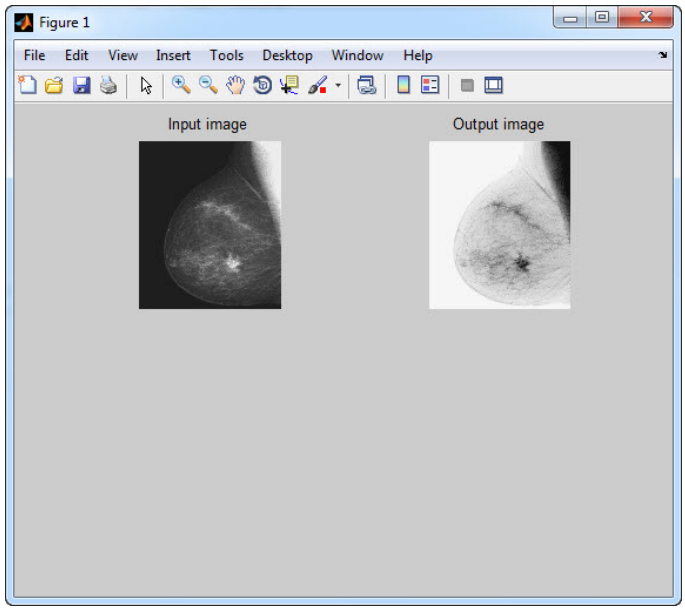

Figure 1: The result image of converting to obtain the negative image.

2) Image enhancement in spatial domain using power-law transformations

2.1 Write the user-defined function in MATLAB which generates the brightness of an image by applying the power-law transformation on the original image, with the following function name: Mypow.m. When this program is used with the image "fractured_spine.tif" result as shown in Figure 2.

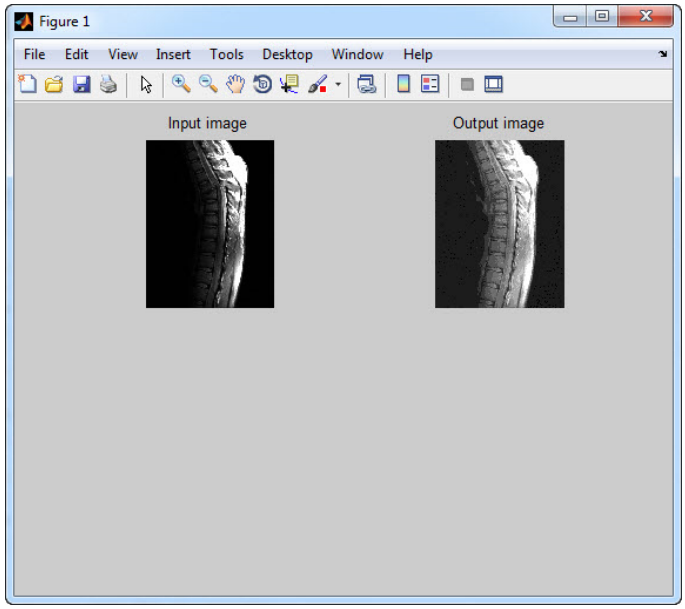

Figure 2: The result image of applying the power-law transformation (with gamma of 0.4) to obtain brightness image.

2.2 By using your own function “Mypow” in section 2.1, generate the darkness of an image by applying the power-law transformation on the original image. When this program is used with the image “washed_out_aerial_image.tif” result as shown in Figure 3.

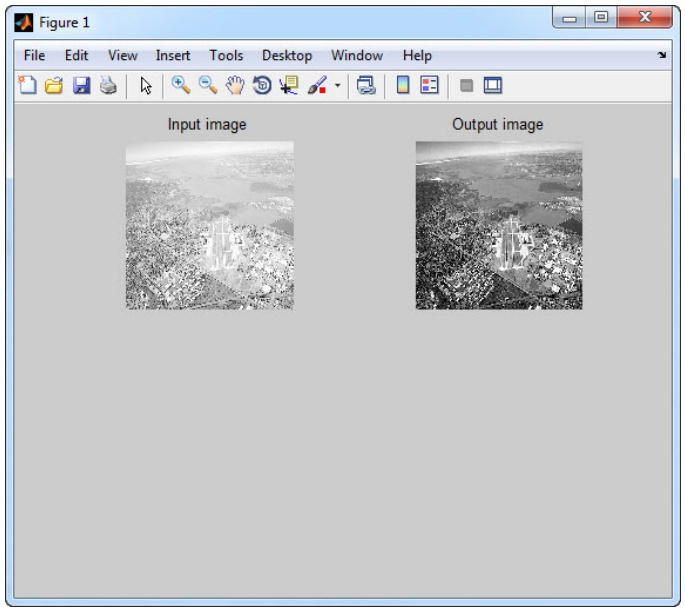

Figure 3: The result image of applying the power-law transformation (with gamma of 3) to obtain darkness image.

3) Image enhancement in spatial domain using gray level slicing

3.1 Write the user-defined function in MATLAB to highlight a specific range of gray-levels in original image, with the following function name: Mygrayls.m. When this program is used with the image "MRI.bmp" result as shown in Figure 4.

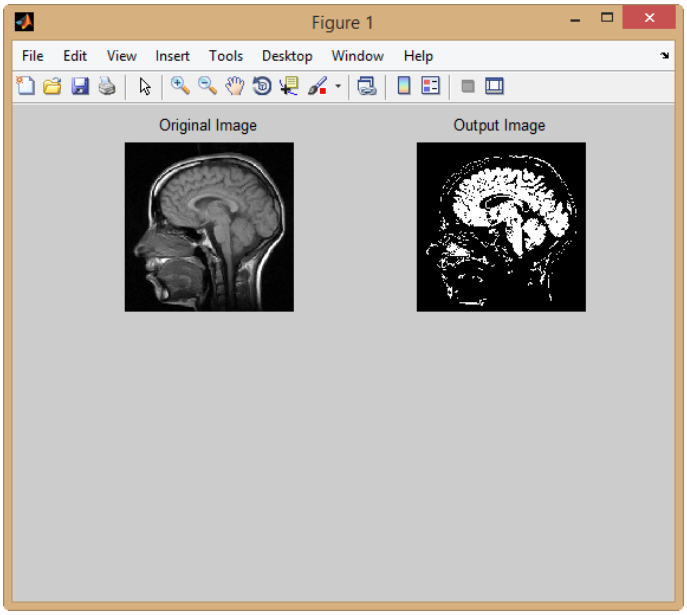

Figure 4: The result image of applying the gray level slicing in which a specific range of gray levels [A,B] (with A of 100 and B of 140) is highlighted, while decreasing all other values to a constant low level.

3.2 By using your own function "Mygrayls.m" in section 3.1, highlight a specific range of gray-levels in original image. When this program is used with the image "MRI.bmp" result as shown in Figure 5.

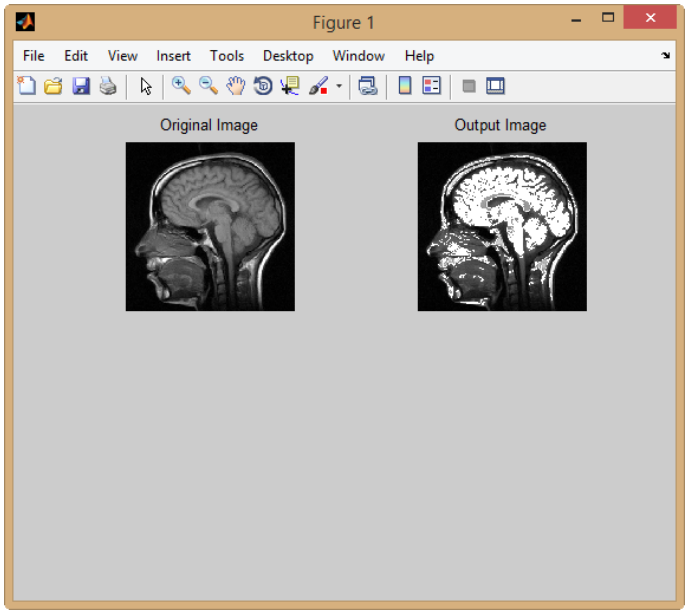

Figure 5: The result image of applying the gray level slicing in which a specific range of gray levels [100,140] is highlighted, while leaving all other values unchanged.

4) Image enhancement in spatial domain using bit plane slicing

4.1 Write a user-defined function in MATLAB for extracting the original image into 8 bit-planes image, with the following function name: Mybitps.m. Using this program on the image "100-dollars.tif" should give you result as shown in Figure 6.

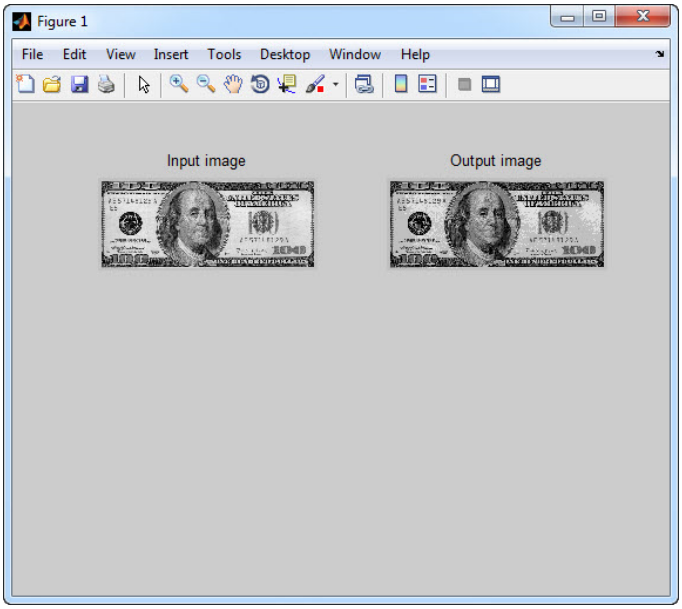

Figure 6: The reconstructed image by putting together 8, 7 and 6 bit-planes.

5) Image enhancement in spatial domain using histogram equalization

5.1 Write the user-defined function in MATLAB to calculate and display the histogram of a original image, with the following function name: Myimhist.m. Using this program on the image "cameraman.tif" should give you result as shown in Figure 7.

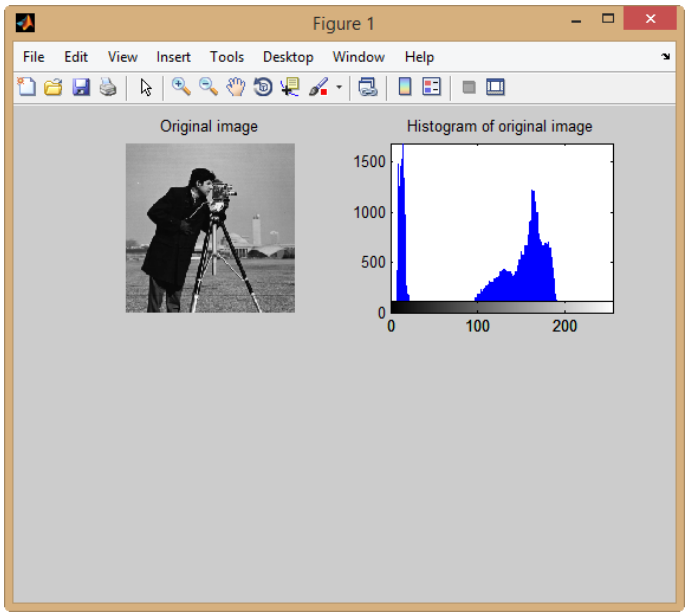

Figure 7: The histogram of original image with 256 gray levels.

5.2 Write a user-defined function in MATLAB for increasing the dynamic range of the gray-levels in the original image, with the following function name: Myhisteq.m. When this program is used with two images "Dark256.tif" and "Low-contrast256.tif", the results as shown in Figure 8 and 9, respectively.

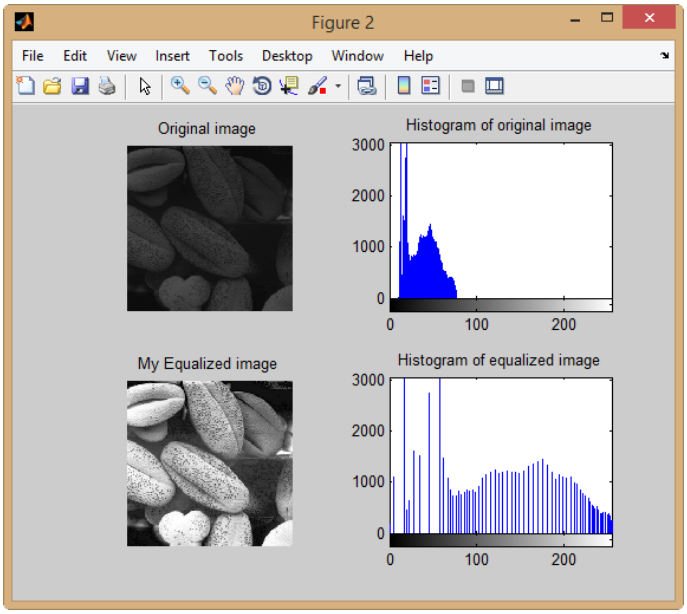

Figure 8: For case the dark image, the result image of applying the histogram equalization.

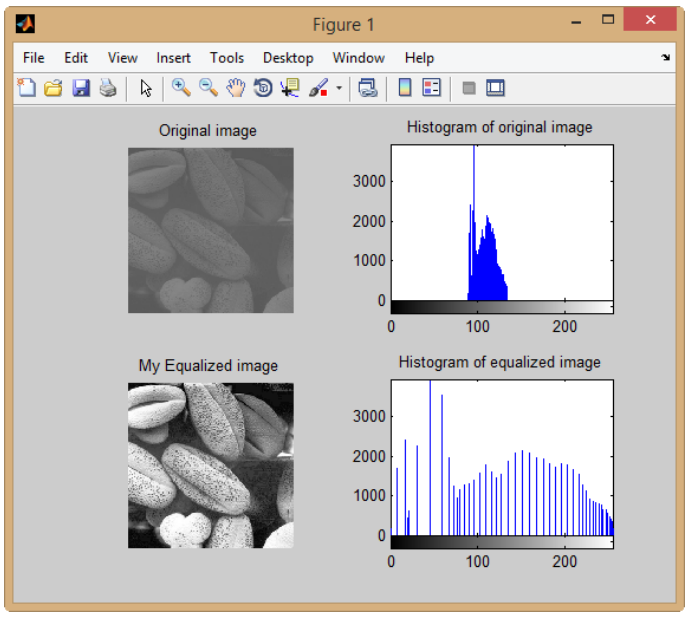

Figure 9: For case the low-contrast image, the result image of applying the histogram equalization.

What you need to submit:

Prepare a zip file that contains all matlab files (m-file extension). Email the zip file to the account **send2narit@hotmail.com** with the following subject line: **EGCI486_LABxx_yyy**, which xx is a number of LAB and yyy is the last 3 digits of the student identification number. Your email should reach us before Monday 11:59 PM.